

AMENDMENT (under PCT Article 34)

To: Examiner of the Patent Office

1. Identification of the International Application

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4. Items to be Amended: Description and Claims

With the above-described problem in mind, the present invention was made. Accordingly, an object of the present invention is to provide: a foot inclination angle measuring method capable of objectively measuring the angle of inclination of a human foot with reproducibility, without requiring skill; a method of 5 selecting (manufacturing), based on the angle of inclination of a human foot measured by means of the foot inclination angle measuring method, a shoe (particularly, such as a custom-made shoe and a corrective shoe) or a shoe sock liner (particularly, such as a corrective sock liner and an sock liner part); and a measuring system capable of measuring the angle of inclination of a human foot.

10 As a solution to the above-mentioned problem, the present invention provides a foot inclination angle measuring method which comprises the steps of: measuring the shape of a human foot in three dimensions; based on three-dimensional data on the measured shape of the foot, obtaining a two-dimensional cross section of the foot orienting in a front-rear direction, which 15 includes a cross section of a heel of the foot; obtaining a central line of the two-dimensional cross section in a right-left direction; and obtaining the angle of inward/outward inclination of the foot from the angle of inclination of the central line.

In accordance with the foot inclination angle measuring method of the present invention, it is arranged that the angle of inclination of a foot is obtained 20 from a cross section of the foot which is obtained based on three-dimensional data on the shape of the foot. Such arrangement makes it possible to objectively obtain the angle of inclination of a foot. In addition, the angle of inclination of a foot is obtained with high reproducibility, without requiring skill.

In the foot inclination angle measuring method, the two-dimensional cross 25 section may be a two-dimensional cross section of the foot in a position ahead of a

rearmost end of the foot by a distance of not less than 4% nor more than 11% of the length of the foot.

Furthermore, as another solution to the above-mentioned problem, the present invention provides a shoe or shoe sock liner selecting method which

- 5 comprises the steps of: measuring the shape of a human foot in three dimensions; based on three-dimensional data on the measured shape of the foot, obtaining a two-dimensional cross section of the foot orienting in a front-rear direction, which includes a cross section of a heel of the foot; obtaining a central line of the two-dimensional cross section in a right-left direction; obtaining the angle of
- 10 inward/outward inclination of the foot from the angle of inclination of the central line; and based on the obtained foot inward/outward inclination angle, selecting a fitting shoe or shoe sock liner for correcting the inward/outward inclination of the foot from among multiple types of previously prepared shoes or shoe sock liners.

In accordance with the shoe or shoe sock liner selecting method of the present invention, it is arranged that the angle of inclination of a foot is derived from a cross section of the foot which is obtained based on three-dimensional data on the shape of the foot. Such arrangement makes it possible to objectively obtain the angle of inclination of a foot with high reproducibility. And, a shoe or a shoe sock liner is chosen based on the obtained foot inclination angle etc. Therefore, it becomes possible to objectively select a shoe or shoe sock liner suitable for correcting the inward/outward inclination of a foot, without requiring skill.

The term "shoe sock liner" used here includes a corrective shoe sock liner. In addition, the term "shoe sock liner" used here further includes not only an ordinary shoe sock liner which is in contact with the entire foot sole but also a shoe sock liner (a so-called sock liner part) which is in contact with a specific part of the

foot sole. In addition, the "sock liner part" is a part which is attached to an ordinary shoe sock liner for locally increasing the thickness of the shoe sock liner.

The shoe or shoe sock liner selecting method may comprise the steps of: obtaining the rate of arch height of the foot from the three-dimensional data on the

- 5 measured shape of the foot; and, based on the obtained foot inward/outward inclination angle and the obtained foot arch height rate, selecting a fitting shoe or shoe sock liner for correcting the inward/outward inclination of the foot and for correcting the flatness of the foot.

The shoe or shoe sock liner selecting method may comprise the steps of:

- 10 obtaining the angle of inward inclination of a first toe of the foot from the three-dimensional data on the measured shape of the foot; and, based on the obtained foot inward/outward inclination angle and the obtained first-toe inward inclination angle, selecting a fitting shoe or shoe sock liner for correcting the inward/outward inclination of the foot and for correcting hallux valgus of the foot.

- 15 In the shoe or shoe sock liner selecting method, the two-dimensional cross section may be a two-dimensional cross section of the foot in a position ahead of a rearmost end of the foot by a distance of not less than 4% nor more than 11% of the length of the foot.

As a solution to the above-mentioned problem, the present invention

- 20 provides a shoe or shoe sock liner manufacturing method which comprises the steps of: measuring the shape of a human foot in three dimensions; based on three-dimensional data on the measured shape of the foot, obtaining a two-dimensional cross section of the foot orienting in a front-rear direction, which includes a cross section of a heel of the foot; obtaining a central line of the
- 25 two-dimensional cross section in a right-left direction; obtaining the angle of

inward/outward inclination of the foot from the angle of inclination of the central line; obtaining the shape of a sole of the foot from the three-dimensional data on the measured shape of the foot; and, based on the obtained foot inward/outward inclination angle and the obtained foot sole shape, manufacturing a fitting shoe or

5      shoe sock liner for correcting the inward/outward inclination of the foot.

In accordance with the shoe or shoe sock liner manufacturing method of the present invention, it is arranged that the angle of inclination of a foot is derived from a cross section of the foot which is obtained based on three-dimensional data on the shape of the foot. Such arrangement makes it possible to objectively

10     obtain the angle of inclination of a foot with high reproducibility. And, a shoe (particularly, such as a custom-made shoe and a corrective shoe) or a shoe sock liner (particularly, such as a corrective sock liner and an sock liner part) is manufactured based on the obtained foot inclination angle etc. Therefore, it becomes possible to manufacture a shoe or shoe sock liner suitable for correcting

15     the inward/outward inclination of a foot, without requiring skill.

The shoe or shoe sock liner manufacturing method may comprise the steps of: obtaining the rate of arch height of the foot from the three-dimensional data on the measured shape of the foot; and, based on the obtained foot inward/outward inclination angle, the obtained foot sole shape, and the obtained foot arch height

20     rate, manufacturing a fitting shoe or shoe sock liner for correcting the inward/outward inclination of the foot and for correcting the flatness of the foot.

The shoe or shoe sock liner manufacturing method may comprise the steps of: obtaining the angle of inward inclination of a first toe of the foot from the three-dimensional data on the measured shape of the foot; and, based on the

25     obtained foot inward/outward inclination angle, the obtained foot sole shape, and

the obtained first-toe inward inclination angle, manufacturing a fitting shoe or shoe sock liner for correcting the inward/outward inclination of the foot and for correcting hallux valgus of the foot.

In the shoe or shoe sock liner manufacturing method, the two-dimensional

- 5 cross section may be a two-dimensional cross section of the foot in a position ahead of a rearmost end of the foot by a distance of not less than 4% nor more than 11% of the length of the foot.

As another solution to the above-mentioned problem, the present invention

provides a foot inclination angle measuring system which comprises: a

- 10 three-dimensional measuring means for measuring the shape of a human foot in three dimensions; a cross section recognizing means for recognizing, based on three-dimensional data on the measured shape of the foot by the three-dimensional measuring means, a two-dimensional cross section of the foot orienting in a front-rear direction, which includes a cross section of a heel of the foot; and an
- 15 inclination angle calculating means for calculating the angle of inclination of a central line of the two-dimensional cross section of the foot in a right-left direction recognized by the cross section recognizing means.

In accordance with the foot inclination angle measuring system of the

present invention, it is arranged that the angle of inclination of a foot is obtained

- 20 from a cross section of the foot which is obtained based on three-dimensional data on the shape of the foot. Such arrangement makes it possible to objectively obtain the angle of inclination of a foot. In addition, the angle of inclination of a foot is obtained with high reproducibility, without requiring skill.

In the foot inclination angle measuring system, the two-dimensional cross

- 25 section may be a two-dimensional cross section of the foot in a position ahead of a

rearmost end of the foot by a distance of not less than 4% nor more than 11% of the length of the foot.

These objects as well as other objects, features and advantages of the present invention will become apparent from the detailed description of the

5 following preferred embodiments with reference to the accompanying drawings.

### **BRIEF DESCRIPTION OF DRAWINGS**

Figure 1 is a view of a human foot wherein Figure 1(a) is a side view, Figure 1(b) is a top plan view, and Figure 1(c) is a rear view;

10 Figure 2 is a schematic block diagram of a measuring system for measuring the shape of a foot sole and so on;

Figure 3 is an illustration of a human foot measured by a three-dimensional measuring instrument wherein Figure 3(a) is a side view and Figure 3(b) is a top plan view;

15 Figure 4 is a perspective view of a human foot;

Figure 5 is a cross sectional view of a human foot; and

Figure 6 is a top plan view of a shoe sock liner.

### **BEST MODE FOR CARRYING OUT INVENTION**

20 An embodiment of the present invention will be described with reference to the drawings.

In the present embodiment, the shape of a foot sole of a customer, the angle of inward/outward inclination of the foot, the rate of arch height of the foot, the angle of inward inclination to a first toe of the foot and so on are measured by a

25 measuring system including a three-dimensional measuring instrument. And,

based on these measured values etc., a shoe sock liner (especially, such as a corrective sock liner and an sock liner part) that properly fits the customer's foot is selected.

based on three-dimensional data on the measured shape of the foot, obtaining a two-dimensional cross section of the foot orienting in a front-rear direction, which includes a cross section of a heel of the human foot;

5        obtaining a central line of the two-dimensional cross section in a right-left direction;

obtaining the angle of inward/outward inclination of the foot from the angle of inclination of the central line;

obtaining the shape of a sole of the foot from the three-dimensional data on the measured shape of the foot; and

10        based on the obtained foot inward/outward inclination angle and the obtained foot sole shape, manufacturing a fitting shoe or shoe sock liner for correcting the inward/outward inclination of the foot.

6.        The shoe or shoe sock liner manufacturing method as set forth in claim 5, 15 comprising the steps of:

obtaining the rate of arch height of the foot from the three-dimensional data on the measured shape of the foot; and

based on the obtained foot inward/outward inclination angle, the obtained foot sole shape, and the obtained foot arch height rate, manufacturing a fitting shoe 20 or shoe sock liner for correcting the inward/outward inclination of the foot and for correcting the flatness of the foot.

7.        The shoe or shoe sock liner manufacturing method as set forth in claim 5, comprising the steps of:

25        obtaining the angle of inward inclination of a first toe of the foot from the

three-dimensional data on the measured shape of the foot; and  
based on the obtained foot inward/outward inclination angle, the obtained  
foot sole shape, and the obtained first-toe inward inclination angle, manufacturing a  
fitting shoe or shoe sock liner for correcting the inward/outward inclination of the  
5 foot and for correcting hallux valgus of the foot.

8. A foot inclination angle measuring system comprising:  
three-dimensional measuring means for measuring the shape of a human  
foot in three dimensions;

10 cross section recognizing means for recognizing, based on  
three-dimensional data on the measured shape of the foot by the three-dimensional  
measuring means, a two-dimensional cross section of the foot orienting in a  
front-rear direction, which includes a cross section of a heel of the foot; and  
15 inclination angle calculating means for calculating the angle of inclination of  
a central line of the two-dimensional cross section of the foot in a right-left direction  
recognized by the cross section recognizing means.

9. **(ADDED)** The foot inclination angle measuring method as set forth in  
claim 1, wherein the two-dimensional cross section is a two-dimensional cross  
20 section of the foot in a position ahead of a rearmost end of the foot by a distance of  
not less than 4% nor more than 11% of the length of the foot.

10. **(ADDED)** The shoe or shoe sock liner selecting method as set forth in  
claim 2, wherein the two-dimensional cross section is a two-dimensional cross  
25 section of the foot in a position ahead of a rearmost end of the foot by a distance of

not less than 4% nor more than 11% of the length of the foot.

11. **(ADDED)** The shoe or shoe sock liner manufacturing method as set forth  
in claim 5, wherein the two-dimensional cross section is a two-dimensional cross  
5 section of the foot in a position ahead of a rearmost end of the foot by a distance of  
not less than 4% nor more than 11% of the length of the foot.

12. **(ADDED)** The foot inclination angle measuring system as set forth in  
claim 8, wherein the two-dimensional cross section is a two-dimensional cross  
10 section of the foot in a position ahead of a rearmost end of the foot by a distance of  
not less than 4% nor more than 11% of the length of the foot.

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